

### Adult and Pediatric IV Station

The questions below are mounted on the easel pads. The answers to these questions will help participants apply critical thinking to the use of IV and IV fluids in trauma.

1. What is the rationale for starting an IV and giving fluids to trauma patients?
  - Trauma patients may be in shock, which is a state of underperfusion of oxygen to tissues, resulting from volume loss, as in hemorrhage, or obstructive shock, as in cardiac tamponade, or distributive shock as in cervical and thoracic cord injuries.
2. How do you determine which patients need to have an IV started and fluid initiated?
  - The patient that needs an IV urgently has signs of underperfusion such as altered mentation, cool pale skin, thin pulses and long capillary refill times.
3. Do trauma patients always have signs and symptoms of volume loss or hemorrhage?
  - Patients must lose a considerable portion of blood volume before they will be symptomatic. Children have a brisk compensatory mechanism but it isn't mature and doesn't last long.
  - Does this mean everyone should get an IV as they might be in shock and there are no signs yet? Discuss with group.
  - Pediatrics: children lose 25% of blood volume before becoming symptomatic.
    - i. Pediatric Blood Volumes

1. Premie	95cc/kg
2. Neo	90cc/kg
3. Up to 1 yoa	80cc/kg
4. >1yoa	70cc/kg
4. Must you/should you always start your IV before leaving the scene?
  - Discuss the Eastern Association for the Surgery of Trauma 2008 Guidelines .

## 2008 E.A.S.T Guidelines for EMS Fluid Resus. in Trauma

**(Type 1 = Standard; Type 2 = Guideline; Type 3 = Option)**

1. Do not perform IV insertion at the scene if it delays transport.(Type 2)
2. If you cannot get an IV after 2 attempts, an IO line should be attempted.(Type 2)
3. IV fluids should be withheld in EMS setting in penetrating torso injuries. (Type 2)
4. Titrate EMS IV fluids to gain palpable radial pulse using small boluses of fluid not continuous (Type3)
5. There is no Type 1 data about isotonic fluid types. (LR vs NS)
6. Fluid rates at KVO are sufficient for transporting injured patients. (Type2)

### 42 studies reviewed

- Trauma patients with EMS IV had worse outcomes than non IV.
- IV start times ranged from 2.2 to 6.3 minutes
- How do we adapt EAST to Montana transport times? Since we have such long transport times, do we go to IV earlier? We can apply IV therapy using critical thinking so we give only what is demonstrated to be needed, being cautious not to overinfuse.

Prehospital IV fluids only improve outcomes if:

- The patient is bleeding at 25-100cc/min
- the IV fluid is equal to the bleeding rate
- The scene and transport time is > 30 minutes

(Lewis FR: Prehospital intravenous fluid therapy: physiologic computer modeling. Journal of Trauma 26:804, 1986)

5. What is an isotonic fluid?
  - An isotonic fluid is one that is similar to serum in its electrolytes and osmolality so that it is less likely to leave the vascular system and absorb into the tissues and cells.
6. Why do we give such a large initial bolus ( 2000cc adult; 20cc/kg peds)
  - Because only 1/3 of it will actually stay in the vascular system long term.
  - Class 1 shock in adults is <750cc of blood loss. Giving 2000cc of fluid, where about 1400 will leave the vascular space, would replace that loss volume.
7. What are the IV sizes and IV sites for adults and children?
8. What is the rationale for the size of catheters and tubing used in trauma IV insertion?
  - Discuss the impact of catheter gauge and length on fluid flow. The goal in trauma IV fluid administration is to use a short fat catheter on wide diameter tubing to maximize flow. Discuss Poiseuille's fluid law, below.

#### Poiseuilles Law

Flow rate is affected by

- *Tube length*
  - Shorter is faster
- *Tube internal diameter*
  - Wider is faster
- *Fluid viscosity*
  - Thinner is faster
- *Pressure gradient* between ends
  - High upstream and low downstream results in faster flow.
  - Pressure bags / gravity

Here are two studies that illustrate the impact of gravity and of catheter gauge.

#### Effect of Catheter Gauge

Catheter	Rate cc/min
20G 30mm	139
18G 30mm	212
16G 30mm	391
14G 30mm	498

Brown N, et al. ( through Level 1 Rapid infuser at steady pressure)

#### Effect of Gauge and Pressure

Pressure?	14G	16G
300mmHg	500cc/min	369cc/min
No press	211cc/min	136 cc/min

Iserson KV, et al

## **IV Insertion**

1. Identify need and determine priority and impact on transport.

- Go back and revisit the EAST guidelines. Show the PHTLS shock algorithm where IV is low down on the intervention pathway. Reinforce that IV insertion should not delay transport and that patient may be continuing to bleed while multiple sticks are attempted.

2. Select site

- For inpatients, nurses are trained to place routine lines most distal (like in hands) so later sticks don't leak. Do we use distal in trauma?
  - i. No we do not as we need a large caliber vein to support a large bore IV
- Non-injured limb and proximal to any injury. (compartment syndrome)
  - i. An injured limb could have damaged vasculature
  - ii. An infiltrated line can cause/contribute to compartment syndrome
- Internal jugular lines may not be a good choice in TBI
  - i. they can impede cerebral venous outflow in TBI contributing to increased intracranial pressure
- Palpate the vein side to side to avoid vein flattening
- Insert at a shallow angle for shallow visible vessels
- Use a deeper angle for deeper nonvisible but palpable vessels.
- Why bevel up?
  - i. Bevel down with block the flashback as the needle rests against the inferior wall of the vein
- Why reduce angle at flashback before advancing?
  - i. To bring the catheter parallel to the venous flow and vein
- Why remove tourniquet before stylet?
  - i. When you pull the stylet, it will bleed backwards out the hub unless tourniquet is off

\* Practice with tools at your stations.